

Two steps ahead

Sandia going all-out to recruit top-tier cybersecurity talent

By Myles Copeland

Wellington Lee loves his job. He loves it so much that when it's over he does it on weekends, at his house, for hours on end, with friends, for fun. Lee is a cybersecurity professional at Sandia. "As a national lab and DOE facility, we're on the forefront of cybersecurity," says Wellington. "We have to be thinking two steps ahead of the adversary. We have the duty and obligation to do our jobs really well."

When that demanding workweek ends, Wellington competes in capture-the-flag cybersecurity challenges as a member of Plaid Paliament of Pwning, a team from his alma mater, Carnegie Mellon University. Contrary to stereotype, Plaid teammates don't swill Monster all night while talking on headsets, preferring instead to share snippets of code via Slack. According to ctftime.org, Google's top search result for "capture the flag rankings," the team is ranked ahead of Tawainese squad "217" for tops in the world.

"It is insanely gratifying," Wellington says of the competitions. "When you solve a challenge, it feels really good."

A worldwide shortage

Wellington seems to be exactly the person David White describes when asked what makes a good cybersecurity employee. "People who have a passion for not letting things go unsolved," says David, director of Sandia's cybersecurity organization. "There are people who take it as a personal challenge, like life can't go on without solving that challenge."

Wellington's qualities are needed in large quantity. A worldwide shortage of 2 million cybersecurity professionals looms by 2019, according to a November 2017 *Washington Post* article. The national labs are competing to fill these positions amidst exponential growth in demand stoked by news-making breaches at companies like Equifax.

"The demand for cybersecurity, I don't see it going away," says Talent Acquisition

Operations and Workforce Planning manager Chuck Maheras. "Whether you are Dillard's, a retail store trying to protect PII [personally identifiable information] on credit cards, the government, computing giants like Microsoft and Google, or a national security laboratory, there's an insatiable demand for this talent across all industry segments."

"We'll go to universities," says David, "and the entire master's class has been hired by Google."

To address this challenge, Labs leadership has identified cybersecurity and computer science recruitment and retention as a focus for 2018, and Sandia's Staffing and Recruiting Team is collaborating with hiring managers from different organizations Labs-wide to target appropriate skillsets and speed hiring.

"Rather than letting hiring managers go it alone, we are bringing together a team from across the Labs' programs that most often hire cybersecurity positions," says Human Resources director Rob Nelson.

Pooling resources

Under normal circumstances, a hiring manager will work with human resources to advertise, review applications, and conduct interviews for one vacant position in the manager's area. With cybersecurity's importance across Sandia's programs, resources are being pooled to swiftly collect and review applications, then interview and hire

(Continued on page 4)

Published since 1949

Exceptional service in the national interest

SandiaLabNews

Managed by NTESS, LLC, for the National Nuclear Security Administration



Vol. 70, No. 2
January 19, 2018



Remembering Dr. Martin Luther King, Jr. ... 2



A new front door for Sandia/California 3



Sandia Shoes for Kids Drive 6

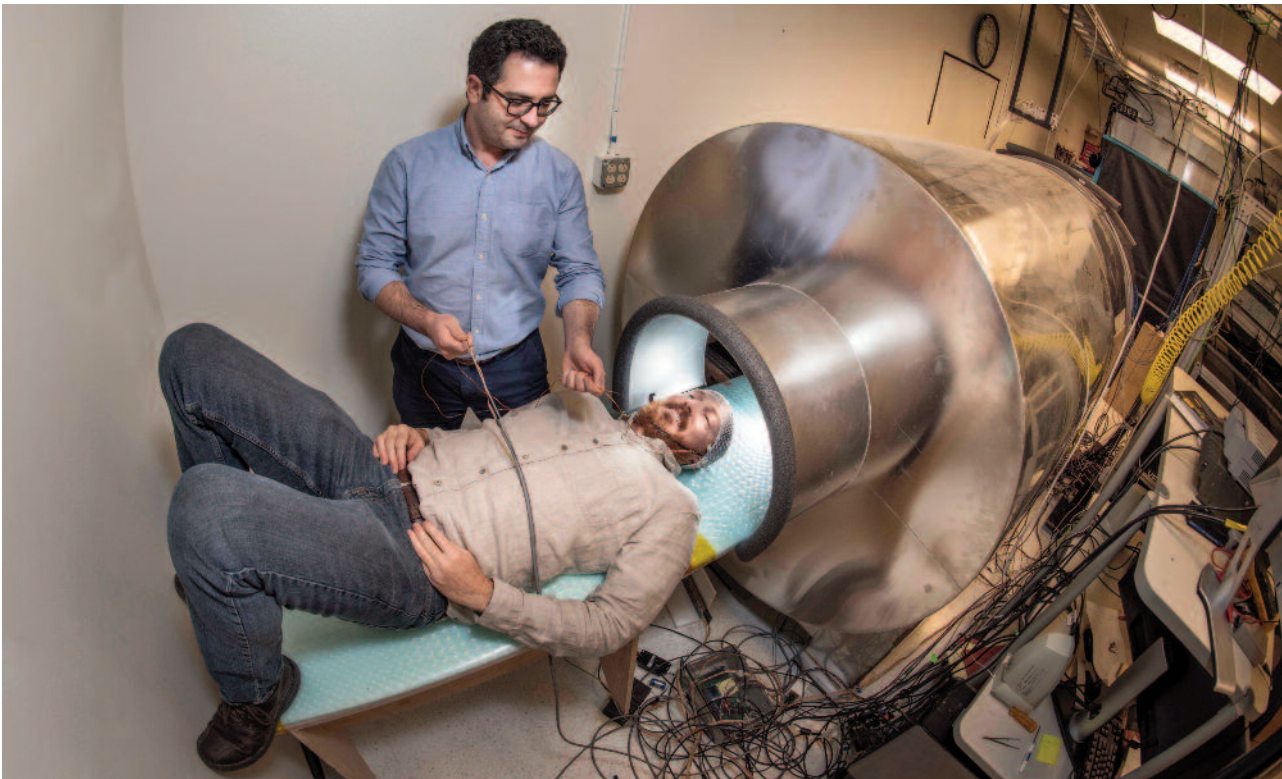
Researchers work on new way to image the brain

By Sue Major Holmes

Sandia researchers want to use small magnetic sensors to image the brain in a way that's simpler and less expensive than the magnetoencephalography system now used. Magnetoencephalography is a noninvasive way to measure tiny magnetic fields produced by the brain's electrical activity. The measurements, able to catch activity as fast as a millisecond, help identify how parts of the brain function and can locate sources of epilepsy and other anomalies.

The state of the art is an array of hundreds of magnetic sensors placed around the head to image the brain by responding to tiny changes in its magnetic fields — sensors called SQUID magnetometers, for superconducting quantum interference device magnetometers. Such systems require magnetic shielding for an entire room and use liquid helium, a cryogen that operates at 4 degrees above absolute zero. Those expensive requirements limit accessibility.

Sandia is developing an optically pumped magnetometer, or OPM, sensor array that fits against the head and is housed inside a human-size shield resembling an MRI tube. It avoids the need for cryogenic temperatures or a shielded room, so it would be easier and cheaper to use.



OPM ARRAY — Sandia postdoctoral appointee Amir Borna aids principal investigator Peter Schwindt in entering the person-sized magnetic shield in preparation for a magnetoencephalography measurement with their optically pump magnetometer array. (Photo by Randy Montoya)

That would make magnetoencephalography more useful for neurology in diagnosing and studying brain conditions and for cognitive science, including emerging research on post-traumatic stress disorder and traumatic brain injury, say the project's principal investigator Peter Schwindt and

former Sandia manager Rob Boye. "Who's not interested in brain science?" Peter says. "It's fascinating stuff."

(Continued on page 5)

That’s that

I got an interesting gadget from my wife as a Christmas gift, one that probably seems a bit odd for New Mexico: a watch that incorporates a tide function (among a bunch of other stuff).

I can set the watch for any beach anywhere in the world and it tells me at a glance what the current state of the tide is: high, low, or anywhere in between. Real handy in the landlocked Southwest, right? Reminds me of the scene in *Casablanca* (perhaps my all-time favorite movie, maybe the most perfect movie ever) where police chief Louis Renault asks cynical American expatriate and saloon owner Rick Blaine what brought him to Casablanca. Rick says, “I came for the waters.” To which Renault replies, “But Casablanca is in the desert.” Rick shrugs and says, “I was misinformed.”

So what am I doing with a tide watch in the desert? Was I misinformed? Hardly. But as much as I love the desert, I’ve always had an affinity for the ocean. To quote another movie, in *Islands in the Stream*, a Hemingwayesque character called Thomas Hudson says of the sea, “She has beauty and great mystery. And she is eternal.” I feel that. As a teenager, I surfed the beach break at Ocean City, Maryland, and later on lived in the postcard-perfect town of Camden in Midcoast Maine, where the tides rise and fall 15 or 20 feet day-in, day-out ceaselessly. I was married in Belfast, right on Penobscot Bay, and the rhythms of the sea were very much a part of the environment.

I set my watch on Christmas day to tell me what the tide is doing in Belfast, where my real life began. Silly? I don’t know, but I love the connection it gives me to a place that was so important in my life.

As you can imagine, I’ve taken a bit of good-natured ribbing about the watch and its relevance here in New Mexico, but it turns out I may have the last laugh.

A few days after Christmas I took the watch to my favorite jeweler and he was fascinated, saying that in all his years of watch repair he’d only seen a couple of watches with a tide function. “What are you doing?” he asked. “Keeping track of the Albuquerque Aquifer?”

When I laughed, he added, “Seriously, I read something in the paper a few years ago that when they measure the depth of the aquifer, they have to take tidal forces into account to get an accurate reading.” Who knew?

It makes sense though; the tug of the moon affects the surge and retreat of the seas, our biological clocks, animal behavior, and, some argue, human behavior, too. Writers have found the tides serve as a good metaphor for all kinds of things. My favorite is the line from Shakespeare’s *Julius Caesar*: “There is a tide in the affairs of men, Which taken at the flood, leads on to fortune. Omitted, all the voyage of their life is bound in shallows and in miseries. On such a full sea are we now afloat. And we must take the current when it serves, or lose our ventures.”

It would be great if my tide watch were able to let me know when that flood in my own life is imminent; I could use some advice that would lead me on to fortune. As it is, I happily settle for a device that, evoking the joy of my boyhood every time I glance at it, says, “Surf’s up!”

* * *

Saw some good news the other day. Turns out the number of deaths by lightning is way down in this country over the past few decades, from 400 in the 1940s to a record low of 16 last year.

The decline is attributable to several factors: far fewer people working in farms and fields and better lightning-proof construction are certainly important, but I think the biggest factor is how good a job safety officers at places like Sandia have done in raising awareness. There was a time when I scoffed at what I thought was an undue fear of lightning. No more. At the first sign of distant rumbles and flashes in the sky I start looking for cover.

No small share of the credit for my own awareness goes to our Sandia safety folks, who over the years have made me much more sensitive to a lot of avoidable risks. I am much more mindful today to the dangers posed by lightning, ladders, electrical devices and wiring, weather, lifting weights, walking on ice, and the list goes on.

You can’t prove a negative, but my hunch is that we owe our safety team a lot more than we know. A whole lot more. So thanks, folks.

See you next time.
— Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

Exceptional service in the national interest

Sandia

LabNews

<http://www.sandia.gov/news/publications/labnews/>

Sandia National Laboratories

Albuquerque, New Mexico 87185-1468
Livermore, California 94550-0969
Tonopah, Nevada • Nevada National Security Site
Amarillo, Texas • Carlsbad, New Mexico • Washington, D.C.

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy’s National Nuclear Security Administration under contract DE-NA0003525.

Bill Murphy, Editor 505/845-0845
Randy Montoya, Photographer 505/844-5605
Patti Koning, California site contact 925/294-4911
Michael Lanigan, Business Manager/Production . . 505/844-2297

Contributors: Michelle Fleming (Ads, Milepost photos, 844-4902), Neal Singer (845-7078), Stephanie Holinka (284-9227), Darrick Hurst (844-8009), Heather Clark (844-3511), Sue Holmes (844-6362), Nancy Salem (844-2739), Valerie Larkin (284-7879), Lindsey Kibler (844-7988), Tim Deshler (844-2502), Mollie Rappe (844-8220), Kristen Meub (845-7215), Michael Padilla (925-294-2447), Julia Bernstein (925-294-3609), Jim Danneskiold, manager (844-0587)

Classified ads 505/844-4902

Published on alternate Fridays by Internal & Digital Communications Dept. 3651, MS 1468

Making the season bright
Sandians collect hundreds of cards
for veterans, service members



SANDIA’S MILITARY SUPPORT COMMITTEE, in conjunction with the Labs’ Diversity & Inclusion organization, coordinated a pre-holiday initiative to collect thank-you cards for military troops and local veterans. Hundreds of Sandians contributed their own creative efforts to the cause and also submitted cards from family members and friends. The cards were distributed before Christmas to the local VA hospital and to deployed troops overseas. (Photo by Randy Montoya)

Honoring Dr. King
Speaker highlights reverend’s
famous Nobel lecture



(Photo by Randy Montoya)

Charles Becknell Jr., director of Africana studies at the University of New Mexico, presented the keynote address at an event this week at the Steve Schiff Auditorium honoring the memory and celebrating the values of the Rev. Martin Luther King Jr. Becknell, who is also senior pastor at Emmanuel Missionary Baptist Church, spoke on the the importance of unity, cooperation, and shared spaces. To set the context for his own remarks, Becknell shared an excerpt from Dr. King’s 1964 Nobel Peace Prize lecture. In it, Dr. King observed,

“Some years ago a famous novelist died. Among his papers was found a list of suggested story plots for future stories, the most prominently underscored being this one: ‘A widely separated family inherits a house in which they have to live together.’ This is the great new problem of mankind. We have inherited a big house, a great ‘world house’ in which we have to live together — black and white, Easterners and Westerners, Gentiles and Jews, Catholics and Protestants, Moslem and Hindu, a family unduly separated in ideas, culture, and interests who, because we can never again live without each other, must learn, somehow, in this one big world, to live with each other.”

The event, attended by more than 200 people, was hosted by the Sandia Black Leadership Committee, and the Team Kirtland Martin Luther King Jr. Observance Committee.

Leadership Livermore class gets
overview of work at California site

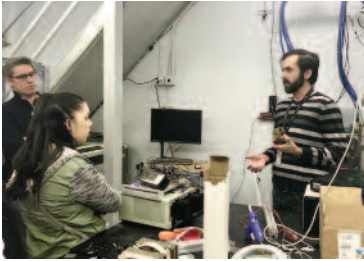


RACEWAYS GROWING ALGAE FOR BIOFUEL RESEARCH, new Sandia-designed tools to cool computers, and models that allow government agencies to plan for fires, floods,

and other natural disasters: A group of visitors from Leadership Livermore were introduced to all these and more when they visited Sandia’s California site on Dec. 12. Leadership Livermore is a nine-month program hosted by the Livermore Chamber of Commerce in partnership with the City of Livermore that strengthens ties between local institutions and business executives. Partnerships officer Stephanie Beasley, pictured above, kicked off the visit with a recap of Sandia’s history and current national security missions.

Mechanical engineer Wayne Staats at right gets animated while explaining Twistact technology to his visitors from the Leadership Livermore program. Invented at Sandia in Livermore and currently supported by the LDRD program, the technology eliminates the need for expensive rare-earth magnets in large wind turbines. It makes it possible to replace rare earth magnets with electromagnets by eliminating sliding electrical contact in favor of purely rolling contact. Wayne compares this to the difference between dragging a sled versus pulling a wagon with wheels. “When something rolls instead of slides, it has lower friction and less wear,” he says.

— Jules Bernstein





A design of their own:

Bringing a ‘wow’ factor to Sandia’s front door

By Patti Koning

Between the expansive, blank lobby walls in Sandia/California’s Human Resources building and the interview candidates who may wait for 30 minutes or more, Kim Edson, senior manager of Business Operations & Human Resources, saw potential. “Many of our interview candidates tend to arrive really early. Every day I’d see them sitting in the lobby surrounded by white walls,” she says. “We were missing an opportunity to make an impact on candidates and show them what Sandia is all about.”

Transforming the HR lobby into a Sandia showcase

Enter creative designers Loren Stacks and Krissy Galbraith of the California Communications and Information Management department. “This was an amazing opportunity for us to create a large-scale environmental design and turn that lobby into a showcase for Sandia,” says Loren. Working on a tight deadline — the project had to be completed in less than six months — Krissy and Loren sought inspiration from a number of sources. They went on virtual tours, scouring the internet for images of environmental design at high-tech companies across the country. “Sandia competes for talent with local tech companies, which typically have well-designed lobbies that wow their candidates,” says Krissy. “Our goal was to make sure that we were on par with those spaces and bring that same wow factor to Sandia’s front door. It was equally important to capture what makes Sandia unique: the people and the culture.”

A bold yet subtle design

With his background in environmental design — see the Isleta resort in Albuquerque for proof — Loren recognized that architectural lettering would yield high impact for less cost than other design options. Using the Sandia purpose statement as a theme, the designers transformed the HR lobby walls with words like INNOVATION, DIVERSITY, and CREATIVITY. “We wanted to be bold with our design but still work with the architecture and existing color palette of the space,” says Loren. Along with a warm charcoal paint chosen to ground the design, Krissy and Loren selected low-contrast white and gray tones for the vinyl and frosted-acrylic letters. The acrylic letters appear to float over the larger vinyl letters, which wrap corners and run across doors and walls to create dimension. Like the letters, the brushed-aluminum Sandia thunderbird is daring in size, yet subtle in color. The design follows the path a candidate might take in the HR building, starting with a mounted iPad where candidates check in electronically, notifying the HR associates and the HR office management assistant. A large monitor plays Sandia videos and photo slideshows to inform and inspire candidates while they wait. As candidates are led into the HR suite toward the interview room, they are greeted by an oversize Sandia thunderbird logo, again in brushed aluminum, on the wall behind the OMA’s desk. Inside the interview room, the design takes a decidedly different turn. “We wanted a pop of color and a design to express our California identity,” says Krissy. After mulling over several iconic California images — the Golden Gate Bridge, beaches, vineyards — they set-

tled on the state flower, the California poppy. Krissy hand-illustrated an original piece of art to showcase the bright orange flower. She and Loren then turned the artwork into a digital image, which was rendered on a canvas, textured wallpaper to cover the room’s back wall. The wallpaper material was chosen for its durability, low cost, and ease of updating.

Bringing environmental-design concepts to life

After months of planning, presenting the design to various groups around the site to gain buy-in, and working with vendors to create the physical design elements, Krissy and Loren were gratified to see the lobby and



interview room transformed over the course of a single week. The designers partnered with the Facilities department on project management and installation. Even though the design has been complete for two months, Kim still feels a jolt of excitement each time she walks into her building. And she no longer minds seeing candidates wait in the lobby. “Now they are walking around, reading the different words on the wall, and learning about our mission, research, culture, and people as they wait,” says Kim. Everyone is invited to visit Bldg. 926 to see the environmental design firsthand. You can check out this time-lapse series (goo.gl/mnV5xN) of photos documenting the installation of the building’s multiple design elements.



Cybersecurity

(Continued from page 1)

candidates. Universal job requisitions have been created for cybersecurity and computer science positions, allowing for continuous recruitment for all positions in those disciplines. A team of managers from across the Labs reviews all cybersecurity applications and routes them to particular hiring managers whose needs match the applicants’ skills.

“It’s about continuously providing a pool of qualified applicants to managers for immediate and ongoing needs,” says Carol Manzanares, Talent Acquisition and HR Strategies senior manager, whose team, including Chuck, partners with managers to recruit and hire.

For managers accustomed to being involved in the hiring process from start to finish, this is an innovative approach aimed at reducing the time it takes to hire. Since assuming her position a year ago, Carol has made changes that have optimized the Talent Acquisition structure and placed a focus on workforce diversity, customer intimacy, process efficiency, and integration and data analysis. These changes are designed to cut the hiring cycle times for all positions at Sandia through improved operational effectiveness and create a better understanding of hiring managers’ business needs.

“Cyber is the perfect example of why we need to be agile and at the ready,” says Carol. “We need to be able to identify and address the next cybersecurity-like recruiting challenge before it happens.”

“We are leveraging our recruiting resources to work for the overall needs of the Labs, rather than one center or one division,” says Talent Acquisition manager Margaret Quinn, another member of Carol’s team. “It’s somewhat of a paradigm shift.”

Looking at the whole person

While Sandia’s cybersecurity positions require US citizenship and typically a master’s degree, the Labs’ 2017 removal of grade-point average requirements from recruiting consideration has created opportunities with some technically qualified candidates.

“We would find students who were exceptional in math and science but maybe bombed history,” says

David. “Not having the GPA criteria can help us to identify them.”

“We haven’t lowered standards,” Carol says. “We’re looking at the whole person — the background, the diversity, the experience. As a national lab, this encourages the diversity of perspectives essential for our success.”

With limited candidates and stiff competition, Carol’s team is working with managers to improve the applicant experience.

Recruiting manager David S. Martinez, who joined Sandia from Intel last fall, found that cybersecurity candidates were being asked to complete a three-page, essay-question intake.

“We’re going to lose strong external talent with long, extended questionnaires, so we engaged with hiring managers to understand, what are the four or five areas that are most important,” says Carol, indicating the intake has been reduced to one page of simple-choice questions.

Understanding managers’ business is essential to the ability of Carol’s staff to anticipate and meet burgeoning challenges, like those presented by the global cybersecurity gap.

“There’s an increased focus on customer service and understanding the customers’ business,” says Staffing manager Annie Hanawalt. “We’re not just taking an order [for a position], but we want to so intimately understand that business that we are able to predict and be telling them, here’s what we see down the road.”

Quickly finding, vetting, and offering positions to candidates is part of the challenge Sandia faces in the competition for cybersecurity talent. Contending with employers who are able to offer stock options, what are



CYBER STRATEGIES — Annie Hanawalt, David Martinez, and Carol Manzanares of Sandia’s Talent Acquisition organization discuss the Labs’ cybersecurity personnel staffing requirements.

Sandia’s advantages? “It’s generally the importance of our mission, and it’s work-life balance,” says David White, explaining that cybersecurity personnel seem to maintain this balance despite critical mission responsibilities. “We have a well-managed organization. We tend to get our work done within the time-frames that we have. In general, I think the culture of Sandia is we are not trying to squeeze that extra dollar, so

we are not cutting corners, which I think can be stressful.”

A peer-based approach

Wellington, who completed his master’s degree at Carnegie Mellon one year ago with financial backing from Sandia’s Master’s Fellowship program, has observed his classmates living in the world of California startups.

“Sometimes I take weekend trips to visit them, and they need to go into work on Sunday morning,” says Wellington. “It seems a lot more stressful than what I am facing personally. Cybersecurity at Sandia is taken seriously. Our management is really good about giving us the resources we need.”

In addition to Sandia’s rare cybersecurity tools, Wellington touts his team’s shared “love of learning,” which is facilitated by a relatively flat organizational structure.

“It’s sort of peer-based,” David White says of cybersecurity at Sandia. “There aren’t a lot of levels to the staff. Most people come in and feel like they’re a peer immediately.”

In line with this peer-based approach, Sandia’s Talent Acquisition team has organized manager listening sessions during early 2018 to garner additional ideas for innovation.

“Talent Acquisition is changing and we want be open and responsive to great ideas from managers throughout Sandia,” says Carol.

“Sandians are smart and resourceful and able to come up with solutions,” says Margaret, who is targeting a summer retirement after a late-career move to the Labs in 2006. “I have so much faith in Sandians rising to the occasion.”



SANDIA cybersecurity professional Wellington Lee says, “We have to be thinking two steps ahead of the adversary. We have the duty and obligation to do our jobs really well.”

AIAA names two Sandians as associate fellows

By Sue Major Holmes

You might say Sandia aerospace engineer Srinivasan Arunajatesan went into the field because of his sister. Sandia colleague Vicente Romero went into mechanical engineering because of exposure to science and technology in school and through extracurricular activities he pursued while growing up.

Srinivasan, who joined Sandia in 2010, and Vicente, who came to Sandia in 1987, have been named 2018 associate fellows of the American Institute of Aeronautics and Astronautics. The institute says only about 1 percent of its members ever achieve that rank.

“It’s a little bit humbling for me,” Srinivasan says. Vicente says he was both humbled and grateful. “To be recognized for all the fun and fulfillment I’ve experienced in engineering over the years is like adding frosting to the cake,” he says.

Srinivasan and his sister were accepted into the prestigious Indian Institutes of Technology the same year, and he says he decided he didn’t want to be in the same classes. Since she was studying materials science, “I said I’m doing anything but materials science.” He’d always liked math and physics, so he went into aerospace. It turned out to be a good fit.

“I didn’t grow up looking at the stars; that was not me. I was much more of a math and physics geek,” he says. “Aerospace back then in India was a very small industry, so the people who were there were there because they really liked it. We had the luxury of having some really good teachers and I got hooked on that.”

Srinivasan graduated with a bachelor’s in aerospace engineering and went to work for a company that made trainer aircraft because he wanted to make airplanes. After a year, “I realized it was not as glamorous as I’d thought,” and he wanted to go back to research. He returned to the India Institutes of Technology on a research associateship, then went on to graduate school at Georgia Tech, where he received master’s and doctoral degrees in aerospace engineering.

He went to work for a company near Philadelphia, where he remained for more than 11 years. Then a Sandia manager he saw at a conference urged him to consider Sandia. Srinivasan applied and was hired.

The aerospace field keeps Srinivasan’s interest because of its difficult problems.



SRINIVASAN ARUNAJATESAN

“I can very confidently say that no matter what I do, the class of problems I work on will not be solved in my lifetime,” he says. “So they’re really, really challenging problems.”

They are also multidisciplinary problems, giving him the opportunity to work with people in other fields. “That has really helped me broaden my horizons,” Srinivasan says. “At Sandia, if you can think of something, there’s somebody working on it.”

Engineering offers challenging problems

Vicente comes from a close-knit Santa Fe family he describes as “an eclectic set of restauranteurs, artists, and flamenco musicians and dancers on one side — except for my dad, who was a plumber — and construction workers on the other side.” There were no engineers in sight, but he pursued his interests in science and engineering through school and his own discovery of the natural world, chemistry, and electronics, and working models of cars, airplanes, and rockets.

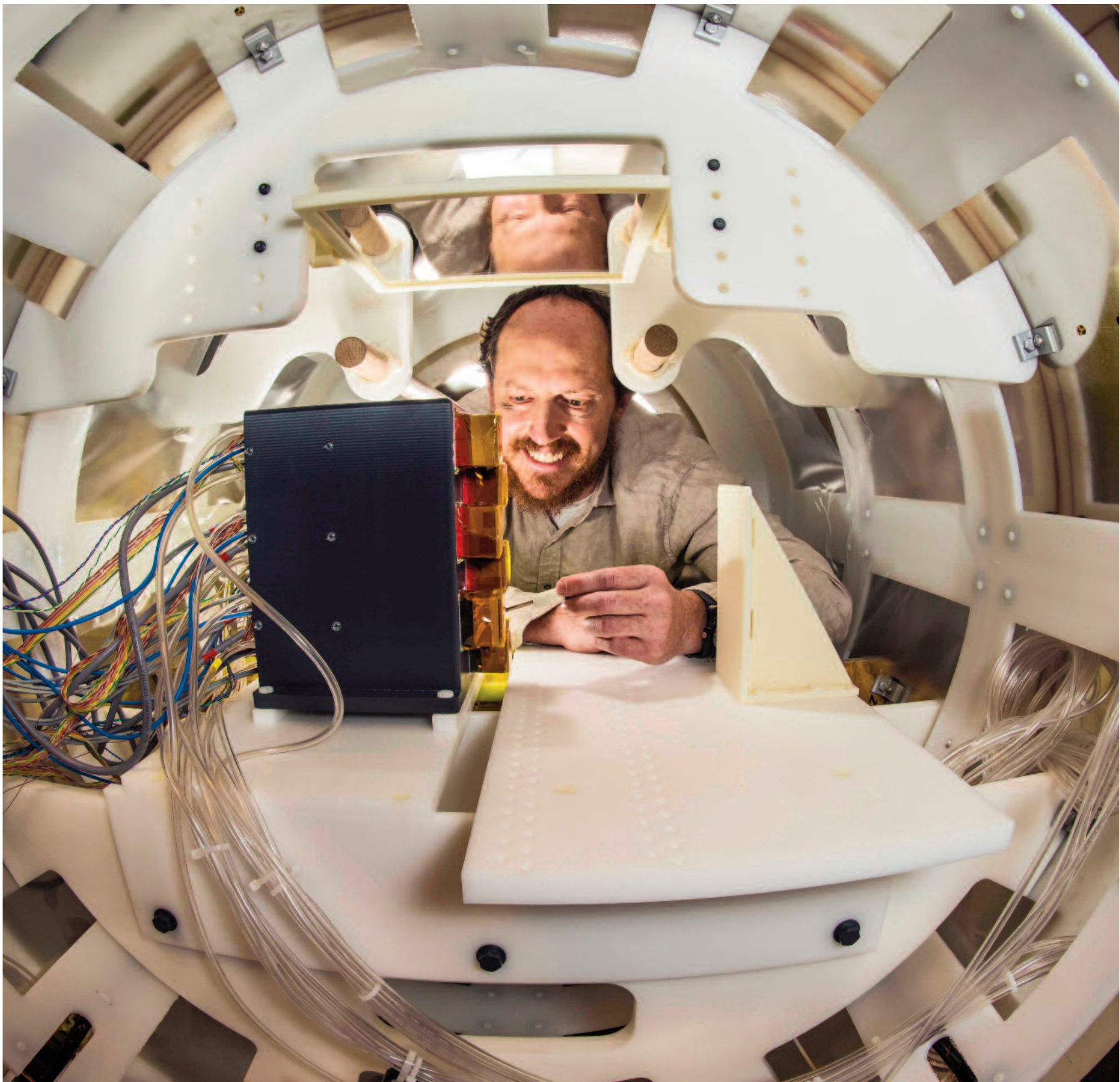
By the end of his junior year of high school, he had decided on engineering in college. He graduated from New Mexico State University with a bachelor’s degree in mechanical engineering and joined Sandia, where he has worked since in various engineering departments. He received his master’s in mechanical engineering from Stanford University under Sandia’s One Year On Campus program and his doctorate in mechanical engineering from the University of New Mexico through the Labs’ University Part Time program.

Vicente says he enjoys “the practice of thoughtful and creative engineering on challenging problems, and am very appreciative of the opportunities Sandia provides with its large and diverse science and engineering portfolio and its important national mission drivers. I have been fortunate to be able to pursue intellectual exploration coupled with rigorous testing and analysis in a number of areas like computational physics modeling and simulation, systems engineering and algorithms for uncertainty quantification and risk analysis.”

Associate fellows, nominated by other AIAA members, have accomplished or been in charge of important engineering or scientific work, have done original work of outstanding merit, or have otherwise made outstanding contributions to the arts, sciences, or technology of aeronautics or astronautics, according to the institute’s website.



VICENTE ROMERO



PETER SCHWINDT, principal investigator for a project to develop room-temperature magnetic sensors for magnetoencephalography, peers at an optically pumped magnetometer sensor array housed inside a person-sized magnetic shield that resembles an MRI tube. His team has published papers on the work it has done to measure magnetic signals from the brain. (Photo by Randy Montoya)

Brain imaging

(Continued from page 1)

The Sandia team published a paper in November in *Physics in Medicine and Biology* that demonstrates Sandia’s system can detect signals from the brain. The team published a paper last year in *Optics Express* describing their OPM sensor.

Demo system developed during four-year project

“Just because you can detect a magnetic field doesn’t mean you know where it’s coming from.”

During a four-year project funded by the National Institutes of Health, Sandia built a prototype magnetoencephalography system with the OPM array placed inside a person-size magnetic shield. The OPM is a quantum sensor that includes a small glass cell containing a gas of rubidium atoms, a pump laser to set the state of individual atoms in the gas, and a probe laser to read the changing state of the atoms. Change in state depends on the strength of the brain’s magnetic field sensed by the array.

The demonstration system featured 20 magnetometer channels in five sensors covering less than a quarter of an adult’s skull. The team wants to image more of the brain in the future by developing an array that covers the whole head, like

today’s SQUID systems.

Sandia compared its findings to those from a commercial SQUID system, using neurology tests that produce well-understood results. One test sounds a quarter-second-long tone in both ears, producing a spike in the auditory cortex. Another test, a nerve stimulus, causes a thumb twitch, resulting in a response in the somato-sensory cortex. Both responses are readily observed with Sandia’s system, and the team uses both responses to characterize and refine its system.

“In essence, you can think of the atoms as little spinning tops,” Rob says. “When there’s a magnetic field present, it’ll make those tops rotate. The probe laser can sense that rotation. In your brain, when a bunch of neurons fire, there’s a little electrical current. Current gives rise to a magnetic field, so it’s the flow of charges in your neurons that gives rise to the magnetic fields sensed by the OPM.”

Commercial SQUID arrays use fixed helmets, with a head-to-sensor distance of at least 2 centimeters and 10 cm or more for children, Peter says. Because Sandia’s array conforms to the head, the head-to-sensor distance is shorter and constant. The team wants to reduce its current distance of 1.2 cm to 0.5-0.7 cm, since the quality of signals from the brain drops off quickly with distance, Peter says.

Making magnetoencephalography more available

Dr. Bruce Fisch, retired professor emeritus at the University of New Mexico Health Sciences Center and former director of UNM’s clinical magnetoencephalography program, says Sandia’s work could make magnetoencephalography more widely available. Fisch, who consulted on the project, says in evaluating epilepsy patients for surgery aimed at stopping seizures, it’s important to locate the source of brain signals more precisely than possible with the more familiar MRI. UNM uses the SQUID system at the Mind Research Network to perform clinical magnetoencephalography scans, Fisch says.

Peter says it’s too early to estimate how much an OPM-

“In essence, you can think of the atoms as little spinning tops. When there’s a magnetic field present, it’ll make those tops rotate. The probe laser can sense that rotation. In your brain, when a bunch of neurons fire, there’s a little electrical current. Current gives rise to a magnetic field, so it’s the flow of charges in your neurons that gives rise to the magnetic fields sensed by the OPM.”

based system would cost. Depending on factors such as auxiliary devices, a comprehensive SQUID-based magnetoencephalography system can cost from \$1.8 million to \$4 million, including a magnetically shielded room, says Miikka Putaala, director of business line magnetoencephalography for Elekta Neuroscience of Finland, which makes such systems.

The next step is to show the system can not only detect signals from the brain, but also pinpoint where the signals originate. Actions such as thinking or contracting a muscle create magnetic fields in the brain, but they’re difficult to isolate.

“Just because you can detect a magnetic field doesn’t mean you know where it’s coming from,” Rob says.

The OPM array is placed over different parts of the head to focus the array on specific areas of the brain. Operators combine information to localize the source of the magnetic field to find where the brain is active.

Sandia’s team is using the measured signals to localize sources in the brain. The team is working to improve the imperfect calibration of sensors and knowledge of the OPM array relative to the position of the brain to continue to improve the accuracy of localizing brain activity.

Fitting the array more closely to the scalp can improve localization accuracy and distinguish between closely spaced neuronal sources. A better fitting array also might detect activity that can’t be sensed now.

“In particular, this can be very interesting for pediatric and infant studies of brain development,” Peter says. “The closer you get, the more spatial fidelity you’ll have.”

Mileposts



New Mexico photos
by Michelle Fleming



William Prgent 40



Paul Gibson 35



Mark Jenkins 35

Recent Retirees



New Mexico photos
by Michelle Fleming



Marion Wilde 40



Tim Moss 35



Michael Swanson 35



Bill Klein 30



Allen Vawter 30



Scott Anderson 37



Ken Sorenson 35



Kathy Silva 25



Joel Stevenson 25



Jay Bennett 20



Richard Drake 20



Sharon Lawson 15



Carter Edwards 20



Bob Knowlton 20



Corey Reitz 20



Carla Sanchez 20



Bruce Thompson 20



Polly Wilks 20



Andy Anderson 15



Wes Crownover 15



Wendy Friedt 15



SHOESforKIDS DRIVE

Shoes will benefit children in Albuquerque and surrounding communities

WAYS TO CONTRIBUTE

CHECKS

Make payable to
APS Education Foundation
P.O. Box 25704, Albq. NM 87125
MEMO: SNL Shoes for Kids

ONLINE

Go to:
aps.edu/education-foundation

1. Donate Box
2. Online Donation
3. Select Amount
4. Select "One Time" or "Recurring"
5. Additional Donation Information Box indicate
"SNL Shoes for Kids"

Drive Kickoff
January 2018

 Sandia National Laboratories

A Sandia Tradition...
60 YRS Strong!

SERVOS
EXCEPTIONAL SERVICE IN OUR COMMUNITIES



Tanya Gallegos 15



Chuck Graham 15



Carissima Heise 15



Richard Miller 15



Tony Romero 15



Val Weekly 15

SANDIA CLASSIFIED ADS

MISCELLANEOUS

KANGAROO CADDY, self-powered, Cadet model, w/rechargeable battery, \$300. Philbin, 505-828-2414.

EMERALD RING, 2.53 carat, green emerald, set in bright gold 4-prong ring, appraised in Albuquerque. Copland, 510-292-5032.

SERVERS, Dell PowerEdge: 1850/2850, \$50-\$100; 1950/2950, \$100-\$125; some R410/710, \$150-\$400; Cisco switches & routers, HDDs, memory. Wolfgang, 515-414-1483.

TIRES, 4, Pirelli Scorpion, 265/60R18, practically brand new, \$500/set. Savage, 505-259-7115.

ROLL-TOP COMPUTER DESK, excellent condition, \$300. Freeman, 296-3452.

SKIS, Telemark, Karhu Outbound, 170 cm, 90-70-80 sidecut, cable bindings, \$90. Lorence, 237-1205.

SOLID OAK CHAIRS, 6, w/contoured seats, ergonomic backs, photos available, \$360 OBO. Weagley, 505-385-4059.

TIMESHARE WEEK, Key West FL, Galleon Resort, May 9-May 26, Google it, \$1,080. Griego, 505-615-9839.

TEMPORARY SPARE TIRE (DONUT), 5-lug, never used, mint condition, \$75. Elliott, 505-792-1002.

VACATION CONDO RENTAL, Pagosa Springs, 2-bdr., 2 baths, sleeps 8, 3 nights, Feb. 16-19, ski Wolf Creek, no pets, \$350. Fernandez, 505-238-4722.

BUNK BED, w/like new mattresses, good condition, \$150; 3 Power Wheels, 12-V, good condition, \$75-\$125 ea. Graham, 505-293-7302.

OUTDOOR FENCING, w/gate, black metal, 12-ft., 40-in. high, \$20 OBO. Sutton, 217-621-6046.

EXERCISE EQUIPMENT, Soloflex butterfly, leg extension, complete barbell, free body & pull

down exercises, \$275 OBO. Hagerman, 505-401-1402, scotihagerman@gmail.com, ask for Scoti.

RANGE & MICROWAVE, GE, white, electric smooth-top range, great condition, \$200/both OBO. Reece, 505-414-3018.

QUEEN BED, American Home, sleigh bed, w/Tempurpedic Rhapsody Luxe mattress & ergo base, \$2,000 OBO. Walter, 505-850-5171.

TWIN BEDS, oak, w/bookcase headboards, 2 side doors, 2 large drawers under very good mattresses, \$200/all. Rightley, 505-610-9853.

RADIANT HEATER, portable, De-longhi, w/timer & thermostat, new, \$25. Holmes, 873-5255.

SIBERIAN HUSKY PUPS, 4 boys, white, 2 females, 1 white, 1 white/brown, in Bernalillo, \$350 ea. Gomez, 261-6402, ask for Terrie.

REFRIGERATOR, GE Profile, \$750 OBO; solid wood bistro set, \$800 OBO; Hoover Floormate carpet cleaner, \$500 OBO. Mills, 217-621-2492.

JOIN FABULOUS FELINES, for their Wild Love Valentines celebration, for details <http://fabulousfelines.org>. Stubblefield, 263-3468.

SECTIONAL, La-Z-Boy Devon, 3 recliners total, very good condition, \$1,500 OBO. Martinez, 505-514-8317.

TRANSPORTATION

'05 HYUNDAI SONATA, 123K miles, clean, call for details, \$2,100 OBO. Rebarchik, 299-1385, ask for Frank.

'08 BMW X5 3.0si, AWD, champagne exterior, brown leather, 25.5-mpg hwy., 2nd owner, 79K miles, no accidents, excellent condition, well below book, \$10,500. Dwyer, 505-249-6935.

'12 SUBURBAN, 4WD, 4-dr., black leather, Sirius XM, remote start, 95K miles, single owner, \$22,500 OBO. Don-

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.

Submit by one of these methods:

- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 844-0645
- MAIL: MS 1468 (Dept. 3651)
- INTERNAL WEB: From Techweb search for 'NewsCenter', at the bottom of that page choose to submit an ad under, 'Submit an article'. If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

nell, 505-241-9111.

'03 FORD EXCURSION, 4WD, 6.0L diesel, loaded w/options, well-maintained, 199K miles, good condition, \$9,900. Jakaboski, 505-933-5532.

'15 HONDA CRV EX-L, 2WD, leather, Bluetooth, XM radio, moon roof, <20K miles, \$21,500. Ruggirello, 716-471-5216.

'06 TOYOTA SEQUOIA LIMITED, well-maintained, single owner, 170K miles, great condi-

tion, \$8,500. Nelson, 505-828-2755.

'05 MUSTANG GT DELUXE, leather, clean, garage kept, only 15.7K miles, brand new tires & stereo, \$13,995. Crespin, 505-203-2852.

'98 HONDA ACCORD, AT, 6-cyl., 200K miles, \$1,000 OBO. Bell, 505-250-6840.

'98 CRV EX, 144K miles, fair condition, \$1,000 OBO. To, 505-553-1611.

'07 TOYOTA CAMRY HYBRID, 121K miles, excellent condition, Carfax report available, \$5,500. Pacala, 856-524-4267.

'09 KIA SPECTRE, manual transmission, one owner, regular maintenance, new tires, \$3,700 OBO. Barr, 505-252-2496.

'11 MINI COOPER HARDTOP, AT, spice orange, 64K miles, new tires, one owner, maintained, \$7,800 OBO. Settecერი, 505-385-6950.

'13 TOYOTA HIGHLANDER LIMITED, maroon, grey leather, 78K miles, transferrable warranty, \$22,900 OBO. Sahlstrom, 505-923-0135, ask for Ted.

'03 VW PASSAT WAGON, manual transmission, charcoal, new brakes, 85K miles, excellent condition, \$3,500 OBO. Podkaminer, 607-279-5050.

'01 SATURN SL2, AT, AC, tan, 123K miles, runs well, outside good, inside fair, \$1,800 OBO. Julian, 505-916-7074.

RECREATION

BIANCHI RACE BIKE, carbon fiber tech, 50 cm, added tube rise to handle bars, super light & fast, great condition, valued at \$2,000, asking \$750 OBO. Willis, 505-379-5232 or 505-304-5034.

'13 V-CROSS VIBE 6504, premium light travel trailer, slide out, bunk beds, TV, AC, nice bathroom, \$14,000. White, 238-2437.

GIRL'S RALEIGH MOUNTAIN BIKE, Ivy, purple, 24-in., age 6-10, great condition, needs rear tube, \$90 OBO. Czuchlewski, 505-359-8241.

MOUNTAIN BIKE, women's specialized Stumpjumper FSR Comp, medium frame, Fox shock, 26-in. wheels, great condition, \$325. Surbey, 505-980-8338.

REAL ESTATE

3-BDR. HOME, large detached shop/garage, wood floors, alley access, special financing, \$150,000. Espat, 505-275-1500, ask for Monica.

2-BDR. HOME, 2 baths, 1,568-sq. ft., charming, East Mountains, 50 Adobe Ln., Sandia Park, new everything, 17 mins. from Sandia, \$165,000. Anderson, 505-453-5522, ask for Lonnie.

5-BDR. HOME, 3 baths, 4,280-sq. ft., in-law quarters, swimming pool, Four Hills. Ramos, 972-951-0290.

3-BDR. HOME, 2 baths, 1,900-sq. ft., solid, tile floors throughout, new countertops, new bathrooms, freshly painted, 1 blk., from La Cueva High. Frances, 505-553-2431.

WANTED

GOOD HOME, cattle dog mix, 3 yrs. old, 40-lb., really cute. Delgado, 505-917-7090.

GOOD HOME, female cat, 4+ yrs. old, black, small, sweet, anxiety issues. Jackson, 505-417-9045.

LOVING HOME OR FOSTER CARE, male cat, 11 yrs old, sweet, playful, call/text for photos. Black, 505-331-9147.

ROOMMATE, Tramway/Copper, furnished upstairs bdr./bath, shared common areas downstairs, no pets, \$500/mo. includes utilities & WiFi. Gibson, 505-275-6680.

Three Sandians elected fellows of the American Physical Society

By Neal Singer

Sandia researchers Carlos Gutierrez, Alec Talin, and Thomas Mattsson have been elected fellows of the American Physical Society. The honor is afforded each year to no more than one half of 1 percent of the members of the society.

Alec, from Sandia/California, was honored "for the discovery of new electronic transport phenomena, materials, and devices." This closely relates to his work in understanding charge transport in a variety of materials and systems, such as semiconductor nanowires, metal-semiconductor contacts, solid electrode-electrolyte interfaces and metal-organic nanoporous frameworks. Alec is also a principal founding editor of the journal *MRS Communications*. He was nominated by the APS Division of FIAP (Forum on Industrial and Applied Physics).

Says Alec, "I have benefited tremendously from early investments by Sandia in the development of experimental tools and theoretical foundations for understanding charge transport in nanomaterials and nanodevices. The fellowship is also a recognition of the collaborators I found at Sandia, NIST, the University of Maryland, and other institutions who have made amazing contributions to my research, and my wife and family's support throughout my career."

Carlos received his PhD at Johns Hopkins University in 1990 and spent two years at the Naval Research Laboratory in Washington, D.C., where he used the then-new techniques of molecular beam epitaxy to grow high-quality magnetic films and multilayer materials. His

work contributed to the foundation of spintronics.

In 1992, he joined the faculty at Texas State University, where he led development of an innovative curriculum with a focus on materials. He developed collaborations with industry that offered job opportunities for his students. In 2005, he came to Sandia to manage the Interface Sciences department, and then in 2012 was selected to direct the Sandia Nanoscale Sciences department. His career-long commitment to diversity has helped recruit underrepresented minorities, and his recognition that outreach activities must begin as early as possible led him to create programs to engage middle school students in science; these have been adopted by university chapters across the country. He has jointly authored research contributions to magnetic, electronic, graphene, and energy materials as well as to surface physics, resulting in numerous joint activities with industry. "I remain active in APS, recently elected as vice-chair for APS GERA [topical group on energy research and applications] and a member of APS PoPA [panel on public affairs]," says Carlos.

Carlos was cited for "contributions to the understanding of magnetic thin film physics, the development of innovative materials-physics education programs, and for research and development leadership in transitioning fundamental materials understanding into a broad range of energy and other national security applications." He was nominated by the Forum on Industrial and Applied Physics,

"At least two Sandians deserve this honor," he quips about the three newly appointed fellows. "Isn't there a



CARLOS GUTIERREZ



ALEC TALIN



THOMAS MATTSSON

law against forced self-incrimination?"

Thomas was cited "for contributions to the fundamental understanding of condensed matter at extreme temperatures and pressures through molecular dynamics and electronic structure simulations." He was nominated by the Division of Computational Physics.

Thomas received his PhD in 1997 from Chalmers University of Technology, Goteborg, Sweden, and has contributed articles and invited talks about matter at extreme conditions. He has led a fundamental science program at Sandia's Z machine — the most powerful generator of X-rays on Earth — since 2011. Through the program, he leads collaborations with academic institutions in the US and Europe, and has been presented a Sandia Distinguished Mentorship Award "for providing ... extraordinary support and research collaboration as the manager to ... postdoctoral colleagues."

"When it comes to my feelings about being selected an APS fellow, it is of course very exciting," says Thomas. "I am deeply honored for the recognition of my research in computational physics. I am also very grateful to my collaborators over the years."

The American Physical Society represents more than 50,000 physicists in academia, national laboratories, and industry in the United States and throughout the world. Its fellowship program "recognizes members who have made exceptional contributions to the physics enterprise, including outstanding physics research, important applications of physics, leadership in or service to physics, or significant contributions to physics education."